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California Institute of Technology
Pasadena, California

Atmospheric Infrared Sounder

Instrument/Spacecraft Operations Status

Denis Elliott

April 21, 2010

Ops Status
AIRS Science Team Meeting
April 21–23, 2010, Pasadena CA

Outline

- **AIRS 28-volt power supply anomaly of January 9, 2010**
- **AIRS operational status**
- **AMSU-A operational status**
- **Aqua spacecraft status**

Anomaly of January 9

Anomaly Description

- **January 9, 2010 at 09:45:40 UT the AIRS Actuator Drive Module (ADM) Group 2 28 V line dropped its voltage to 0.8 V**
- **The AIRS choke point heater and the on-board calibrator heater both turned off at the same time**
- **The drop in voltage on the 28 V line was sudden and no strange behavior was seen until the moment of the drop**
- **No other AIRS subsystems malfunctioned before or after the anomaly**
- **Nothing unusual was seen in the spacecraft telemetry**

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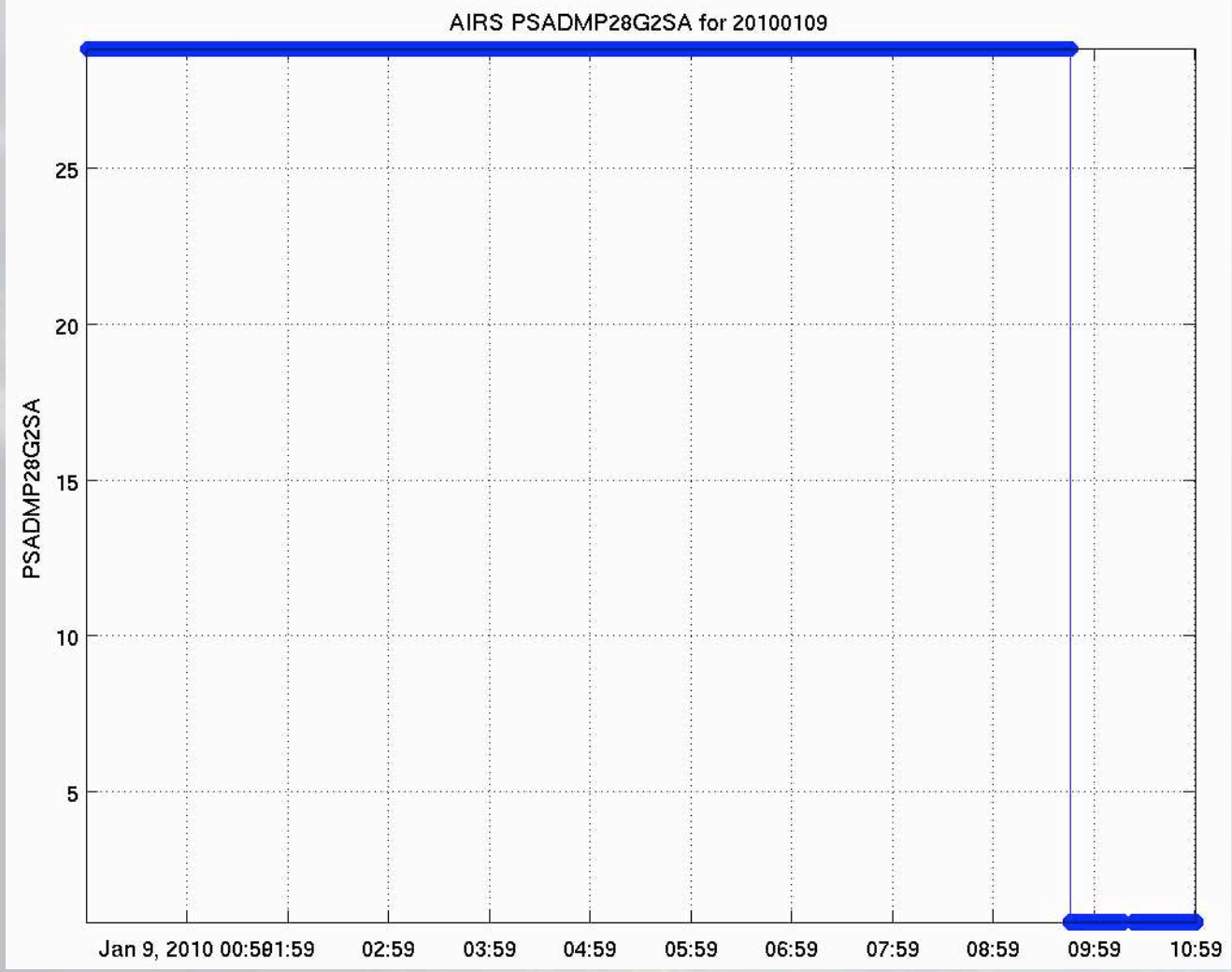
AIRS ADM 28 V Power Supply Voltage



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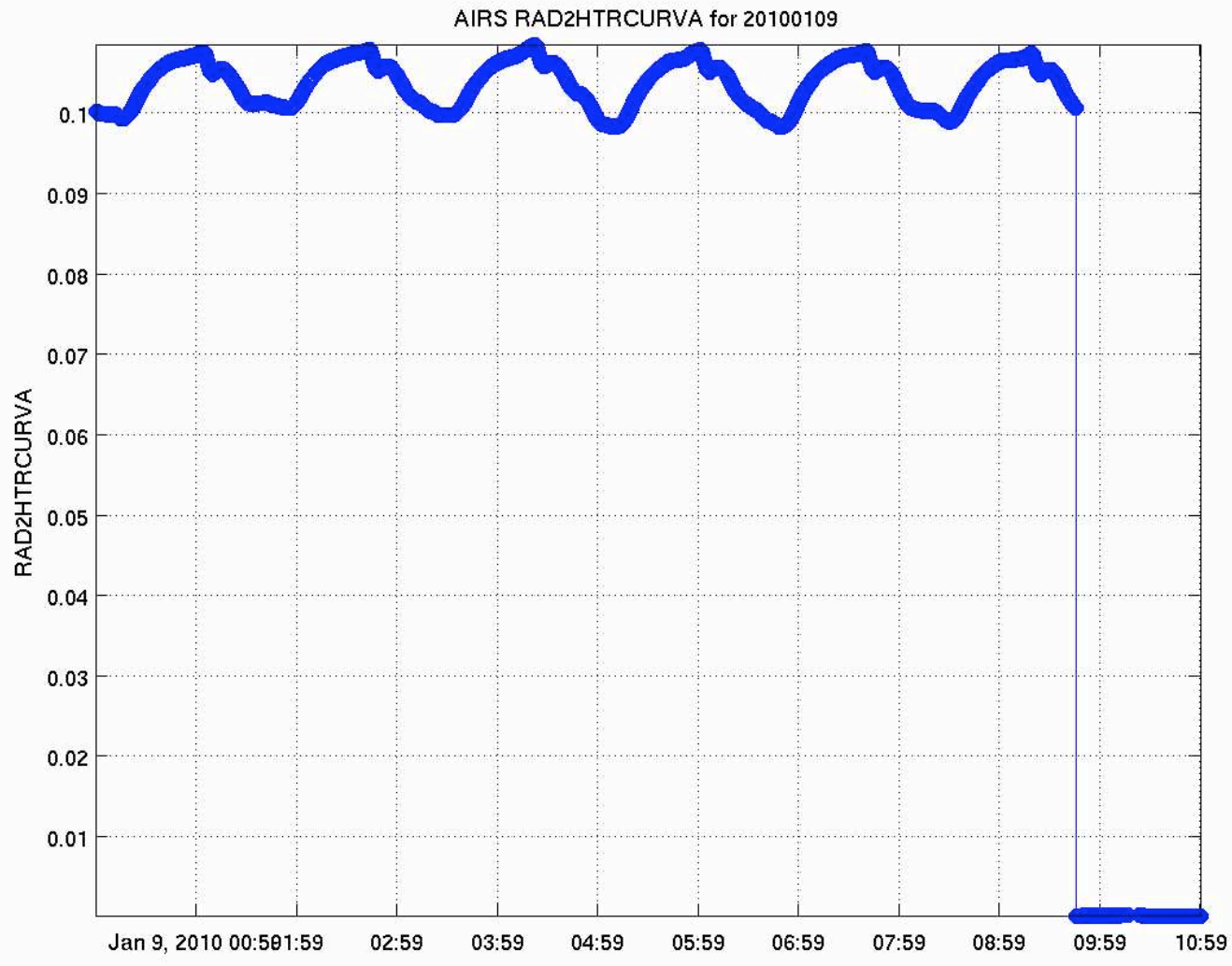
AIRS Choke Point Heater Current



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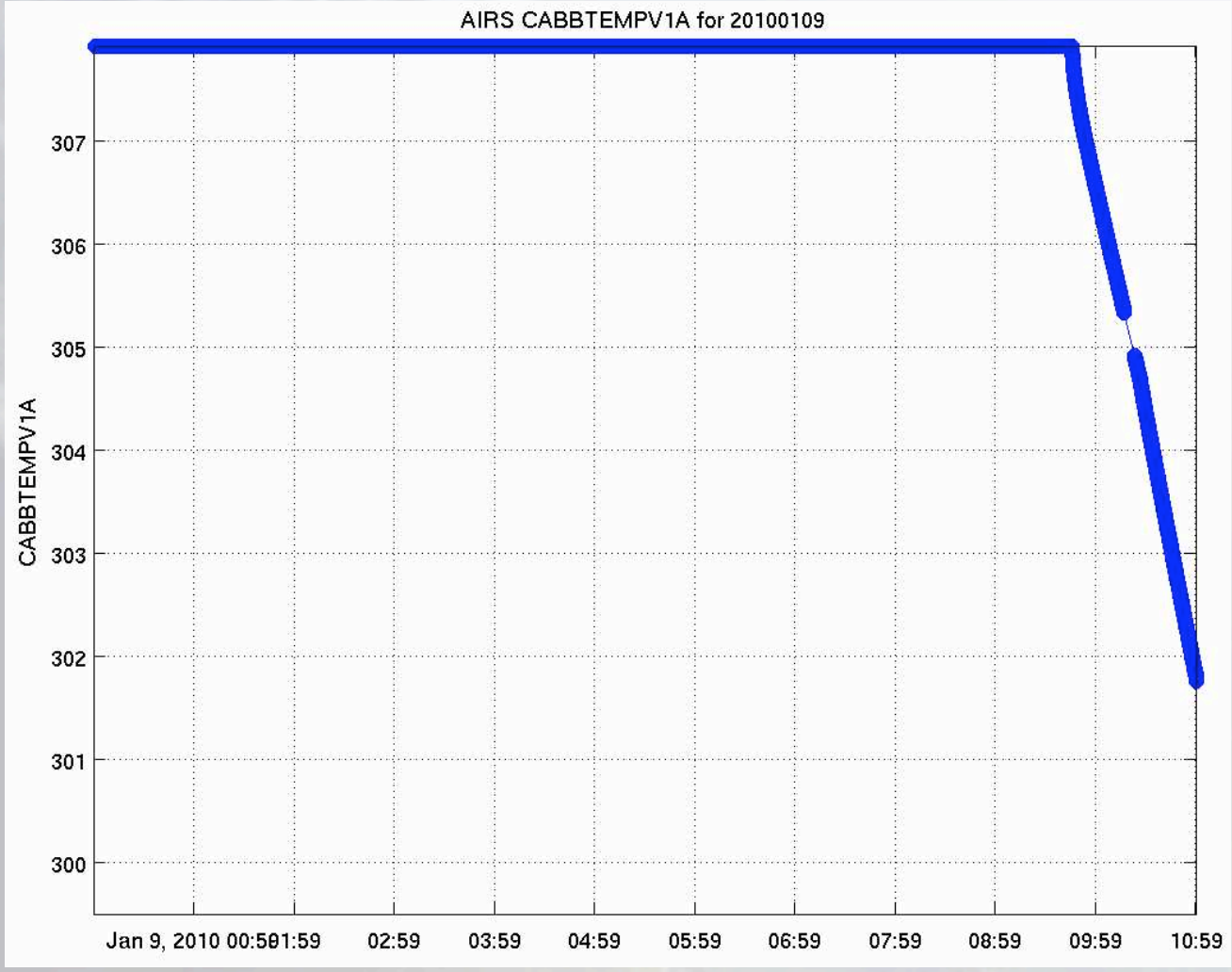
AIRS OBC Temperature



Immediate Actions Taken

- **The Aqua Flight Operations Team (FOT) at Goddard has instructions on how to respond to any red alarm**
- **The FOT ran the designated alarm response procedure as soon as the problem was detected**
  - ***Focal plane, scanner, chopper, and high rate telemetry were shut down in an orderly manner***
  - ***Group 2 power turned off***
  - ***Flight control computer, low rate telemetry, and both coolers remained on***

Anomaly Response Team Actions (1 of 2)

- **The procedures in the AIRS Anomaly Resolution Management Plan were followed**
- **A combined team from several institutions analyzed the telemetry data**
  - ***AIRS Project***
  - ***Earth Science Mission Operations (ESMO) project at GSFC (the parent organization of the Aqua FOT)***
  - ***BAE Systems (AIRS system contractor)***

Anomaly Response Team Actions (2 of 2)

- An SEU that activated a crowbar circuit was suspected
- Since turning off Group 2 power resets the crowbar, the recommendation was simply to turn everything back on, monitoring closely as we went
- A Command Authorization Meeting (CAM) was held on January 19 at which the detailed recovery plan was approved

Recovery Timeline

- **Bringing up the subsystems took place over two days, January 20–21**
- **Minor adjustments were made on January 22**
- **The detector gain/circumvention table was uploaded on January 23—at that point the science data was back to normal**
- **AIRS put back in OPERATE mode on January 26**

Conclusions

- **The hypothesis that an SEU caused the activation of the crowbar circuit appears to have been correct**
- **AIRS suffered no damage from the incident**
- **The AIRS spectral calibration was not significantly affected, because the focal plane did not warm up (coolers remained on)**
- **AIRS science data quality before and after the anomaly is the same**

AIRS Status

AIRS Operational Status

- **AIRS is in excellent health**
- **All engineering parameter plots versus time are either flat or changing extremely slowly—no concerns**
- **A few channels have degraded noise performance due to radiation dosage on the ROIC's**
  - ***More on the status of the channel noise properties and possible improvements in Steve Broberg's talk on a proposed new gain table (Friday morning)***

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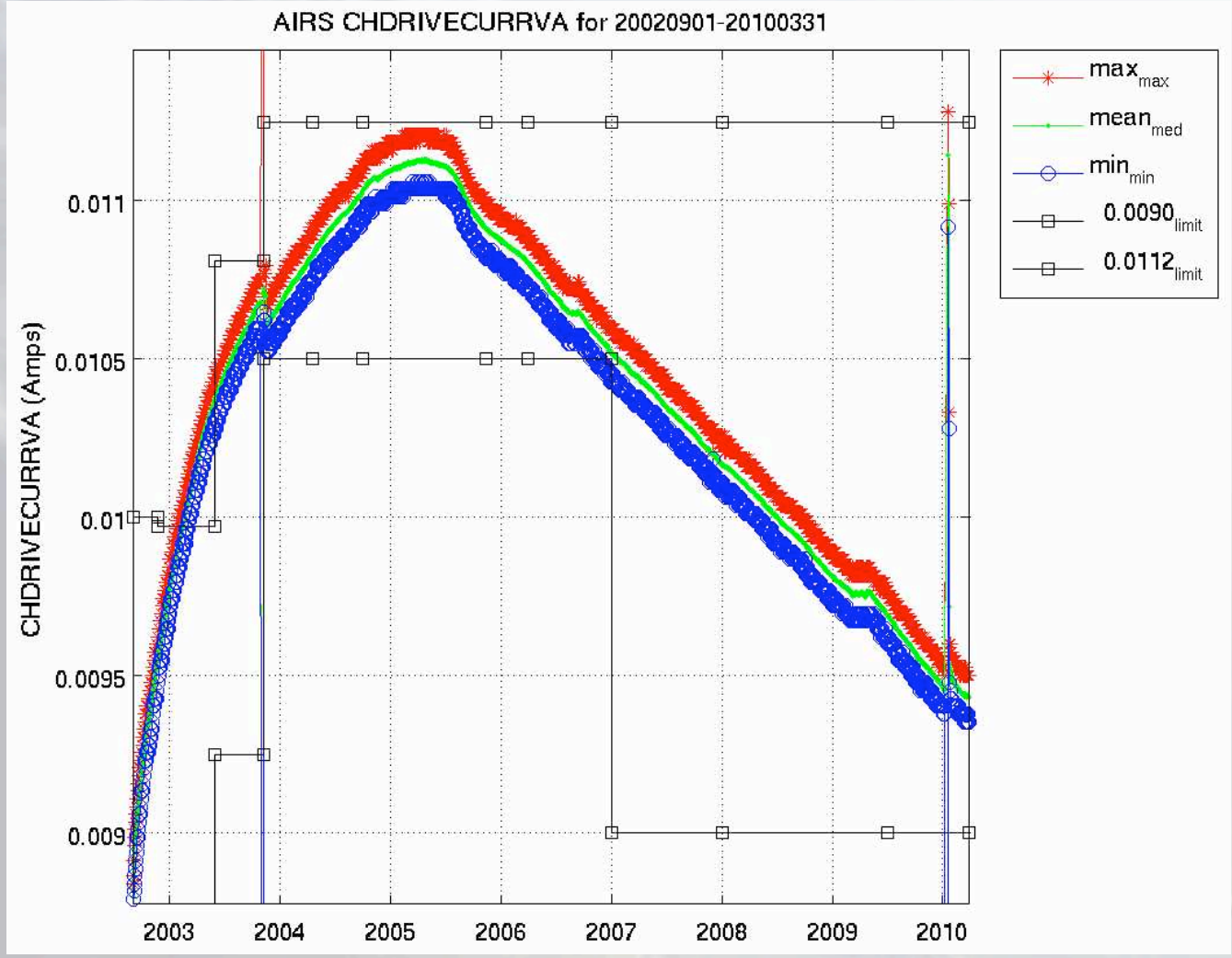
AIRS Chopper Drive Current



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AIRS Scan Mirror Temperature

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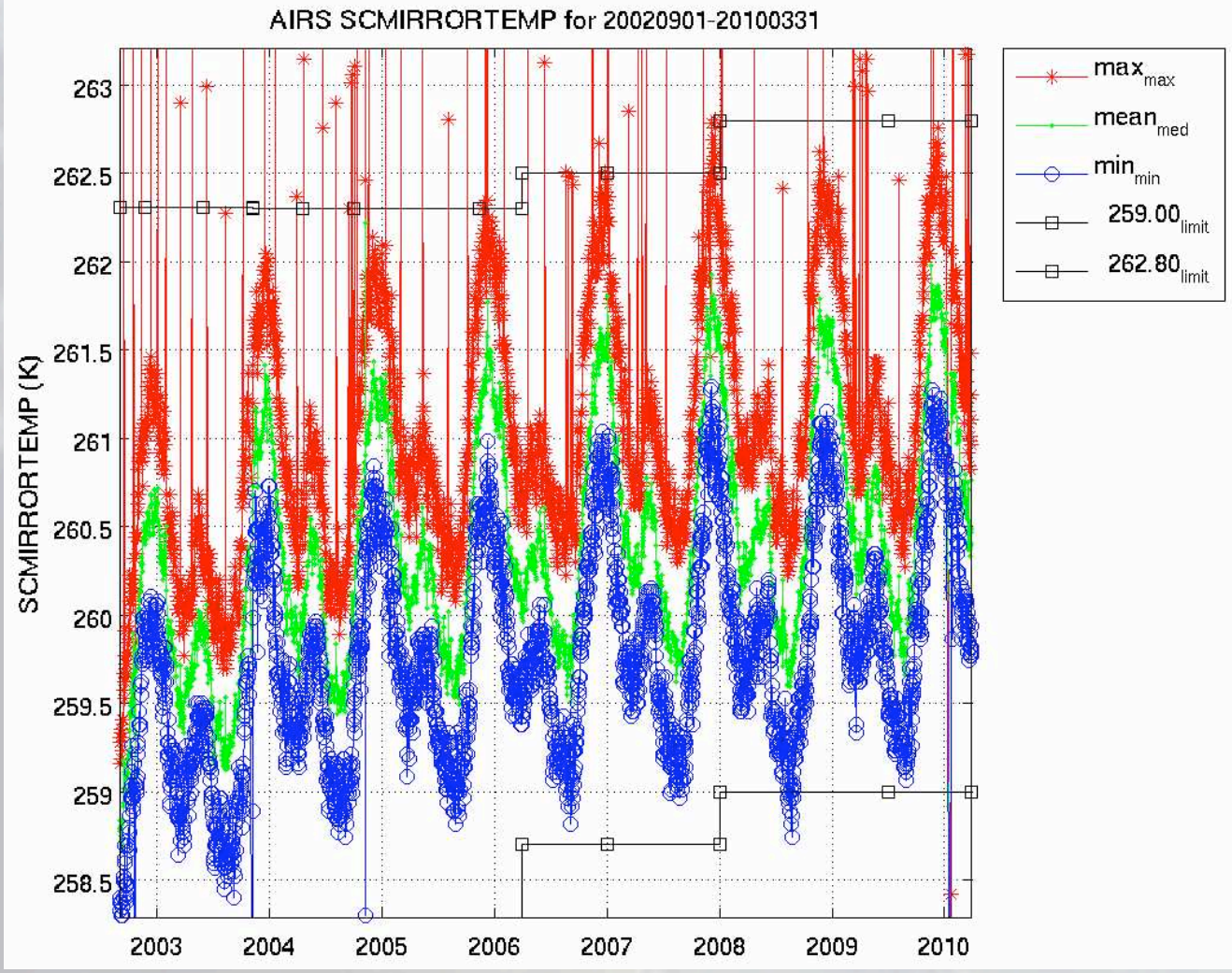

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AIRS Choke Point Heater Current

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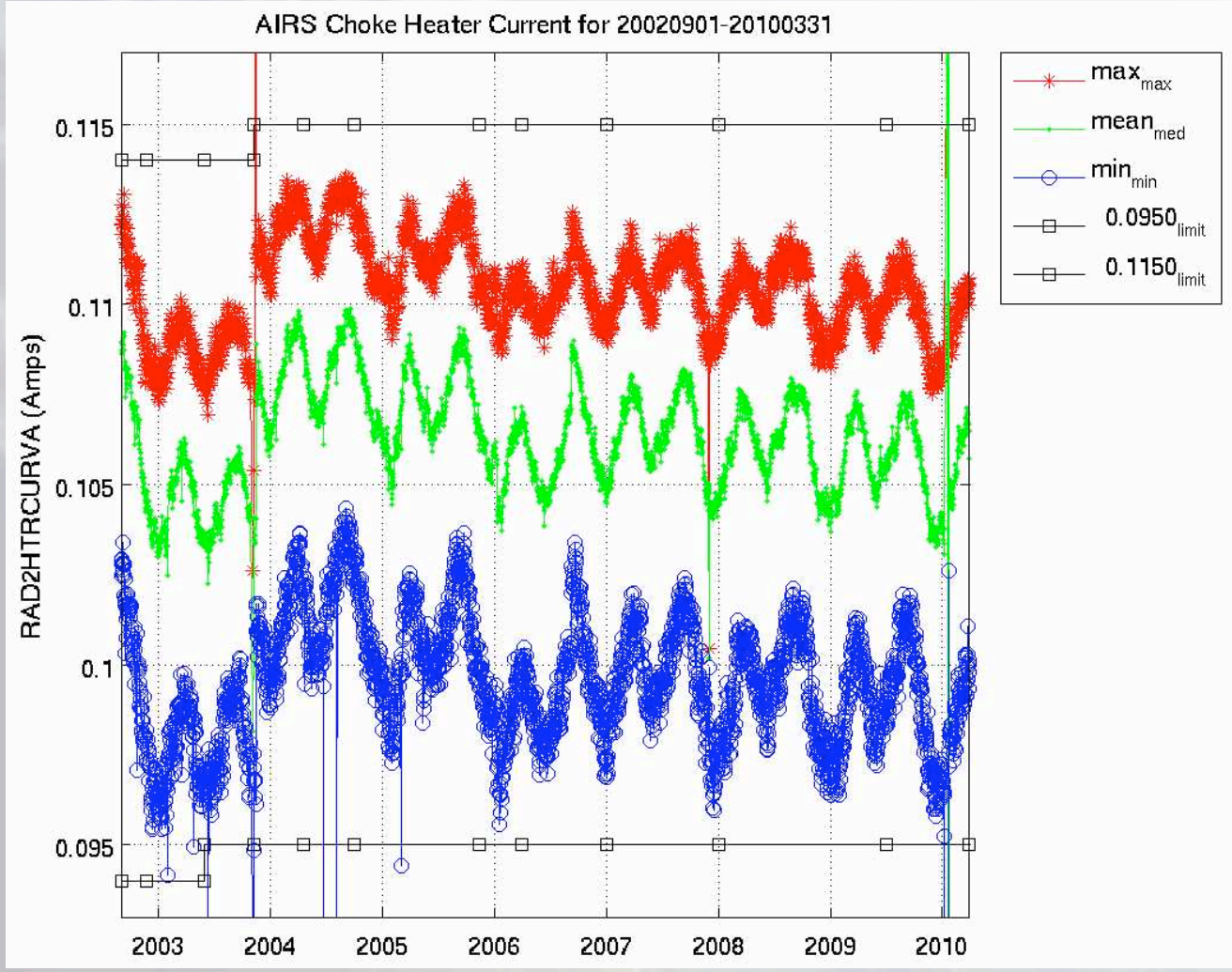

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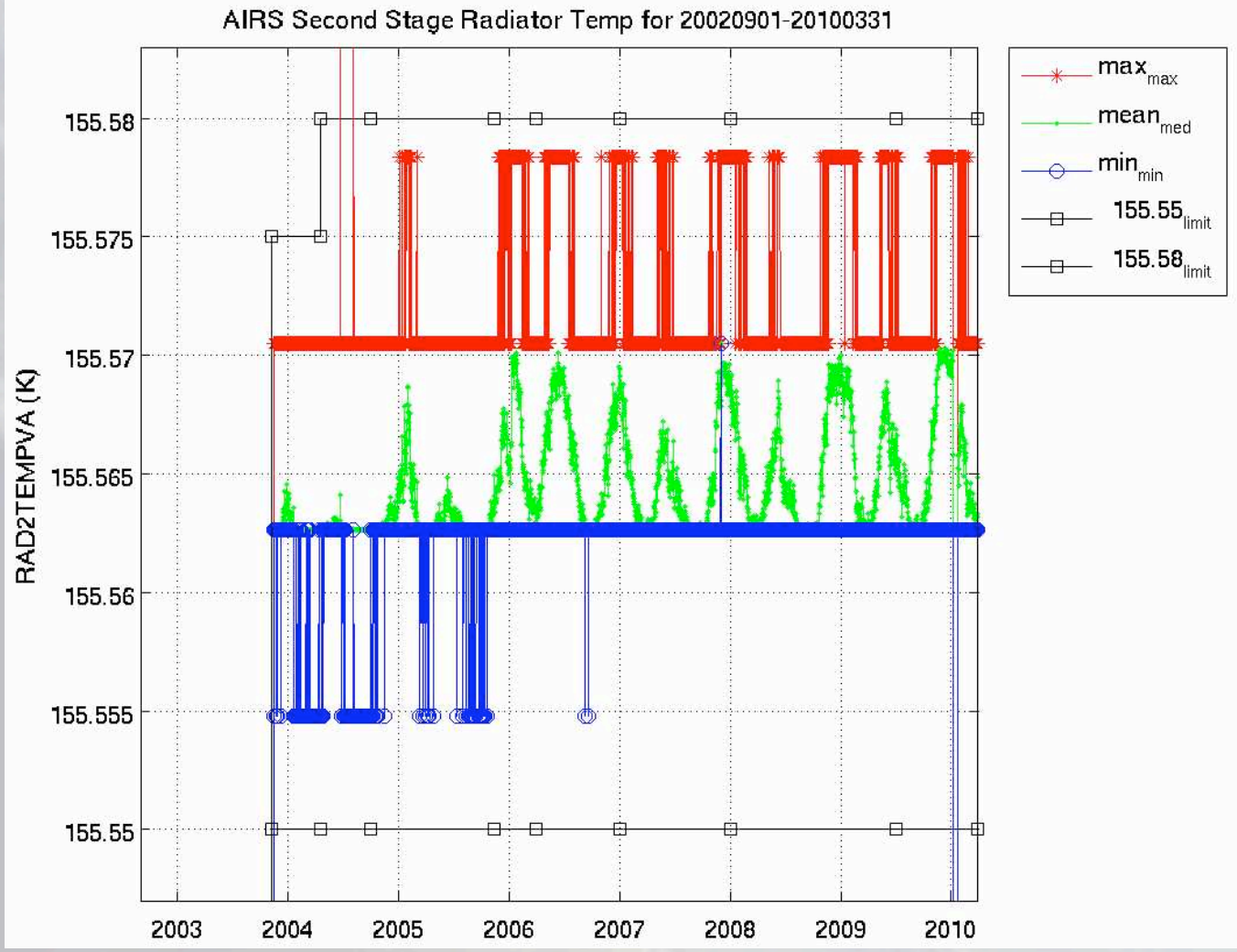
AIRS Second Stage Radiator Temperature



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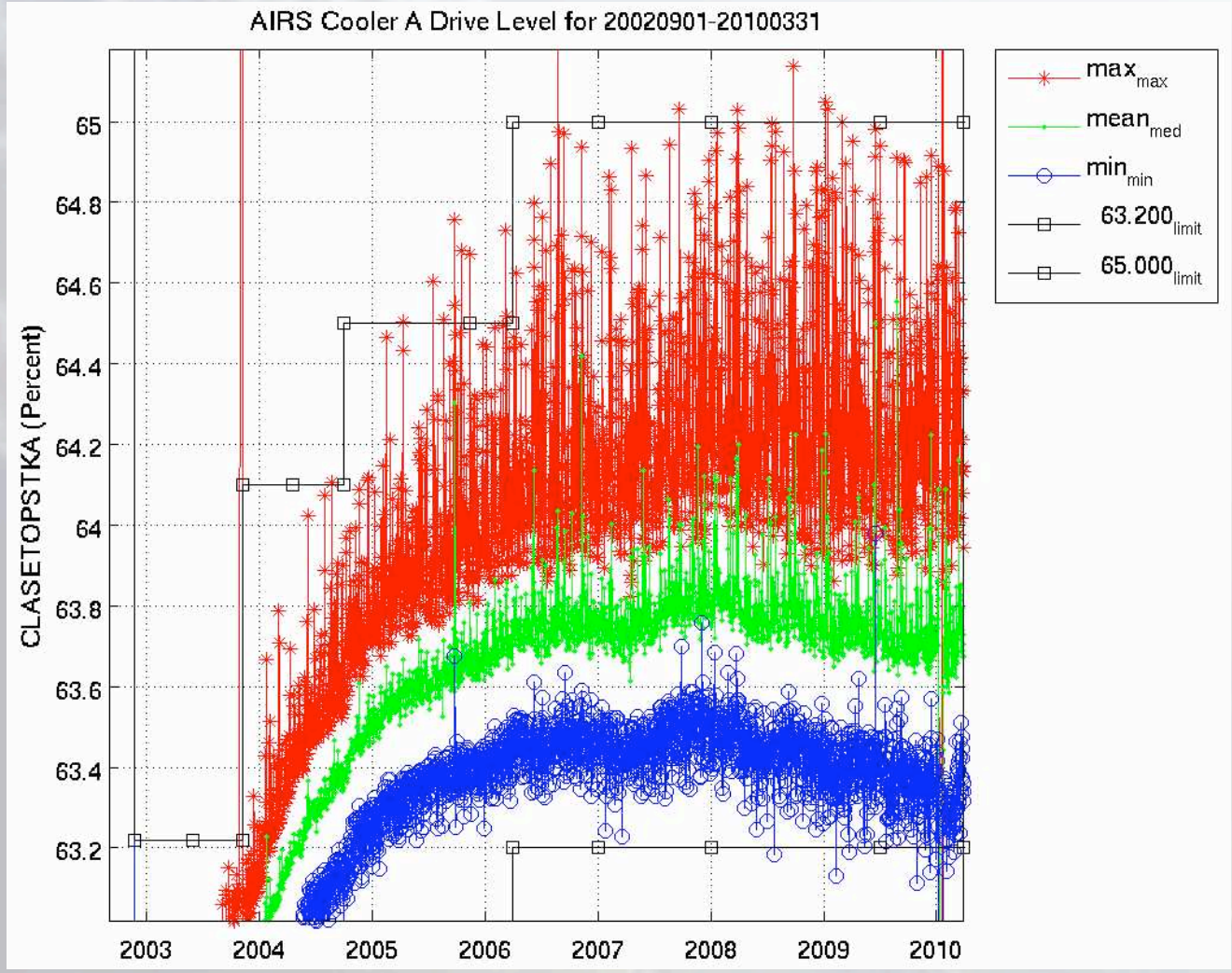
AIRS Cooler A Drive Level



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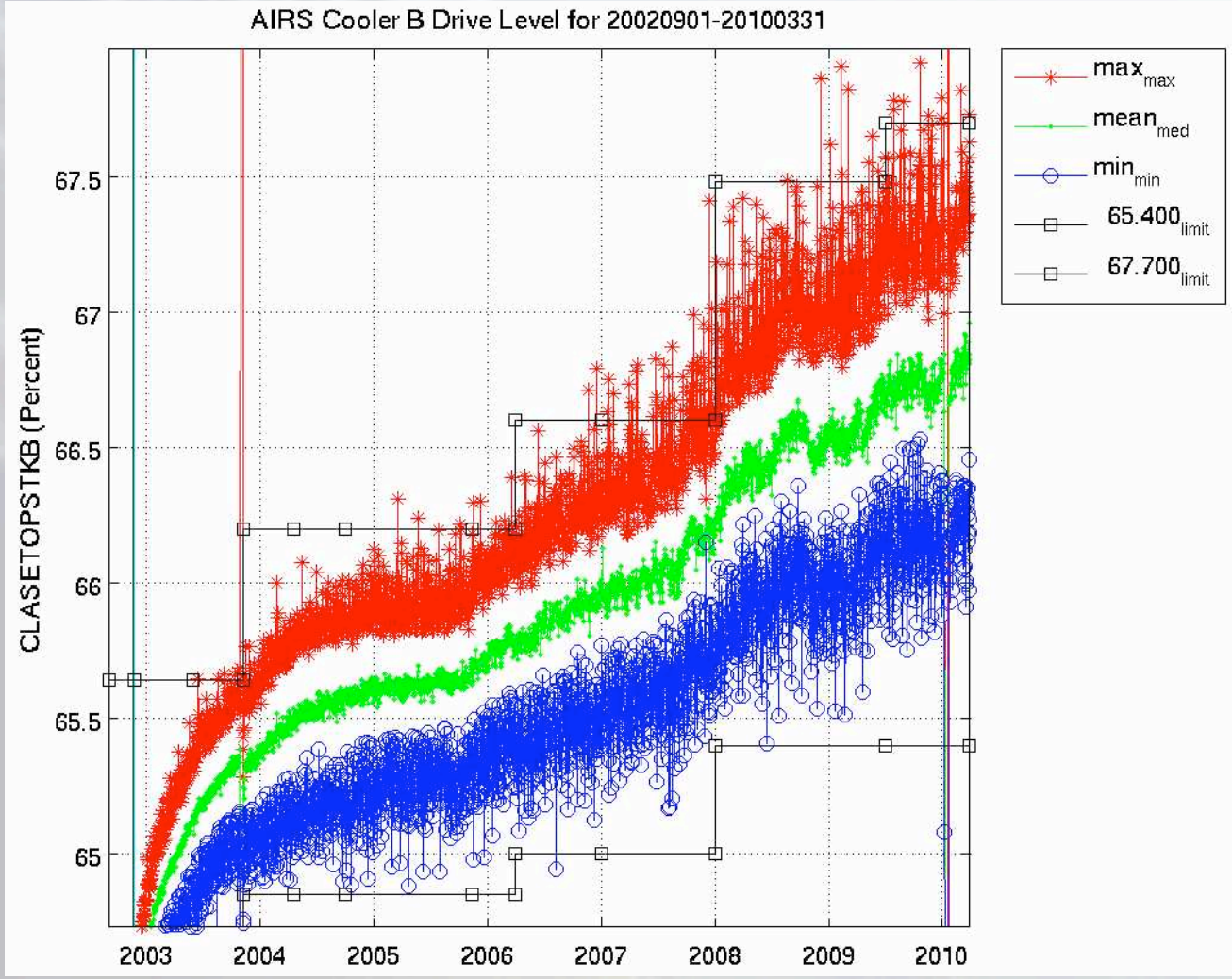
AIRS Cooler B Drive Level



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AIRS Focal Plane Temperature

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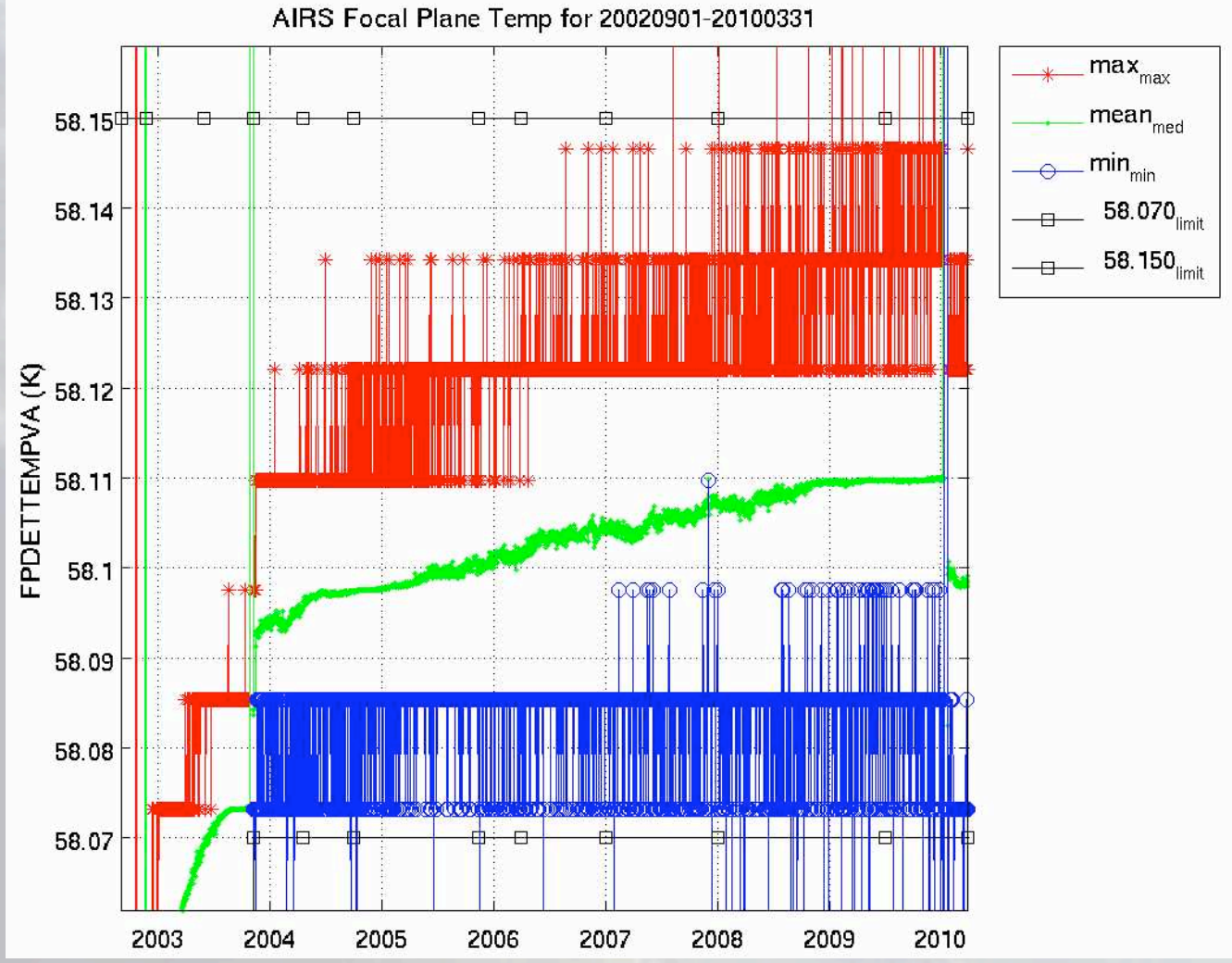

AMSU-A Status

AMSU-A Operational Status

- **AMSU-A mechanical parts and most of the electronics are in very good health**
- **Engineering parameter trends are slow—no concerns**
- **12 of the 15 channels are rock solid, but**
  - ***Channel 4 failed in 2007 (declared non-operational on October 1 2007)***
  - ***Channel 5, while still useful, is steadily degrading***
  - ***Channel 7 has been noisy since launch and has never been used***

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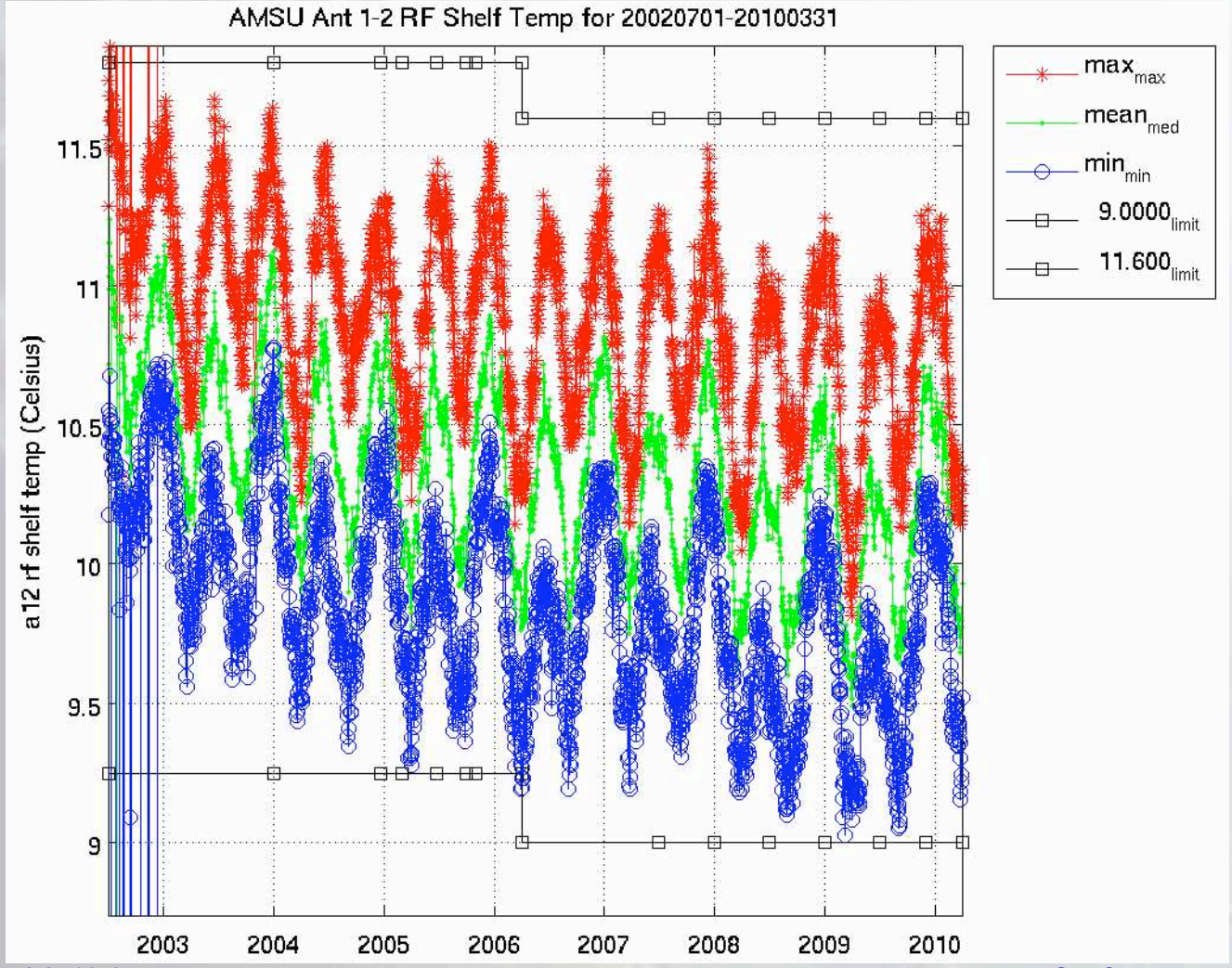
AMSU-A1-2 RF Shelf Temperature

Atmospheric Infrared Sounder



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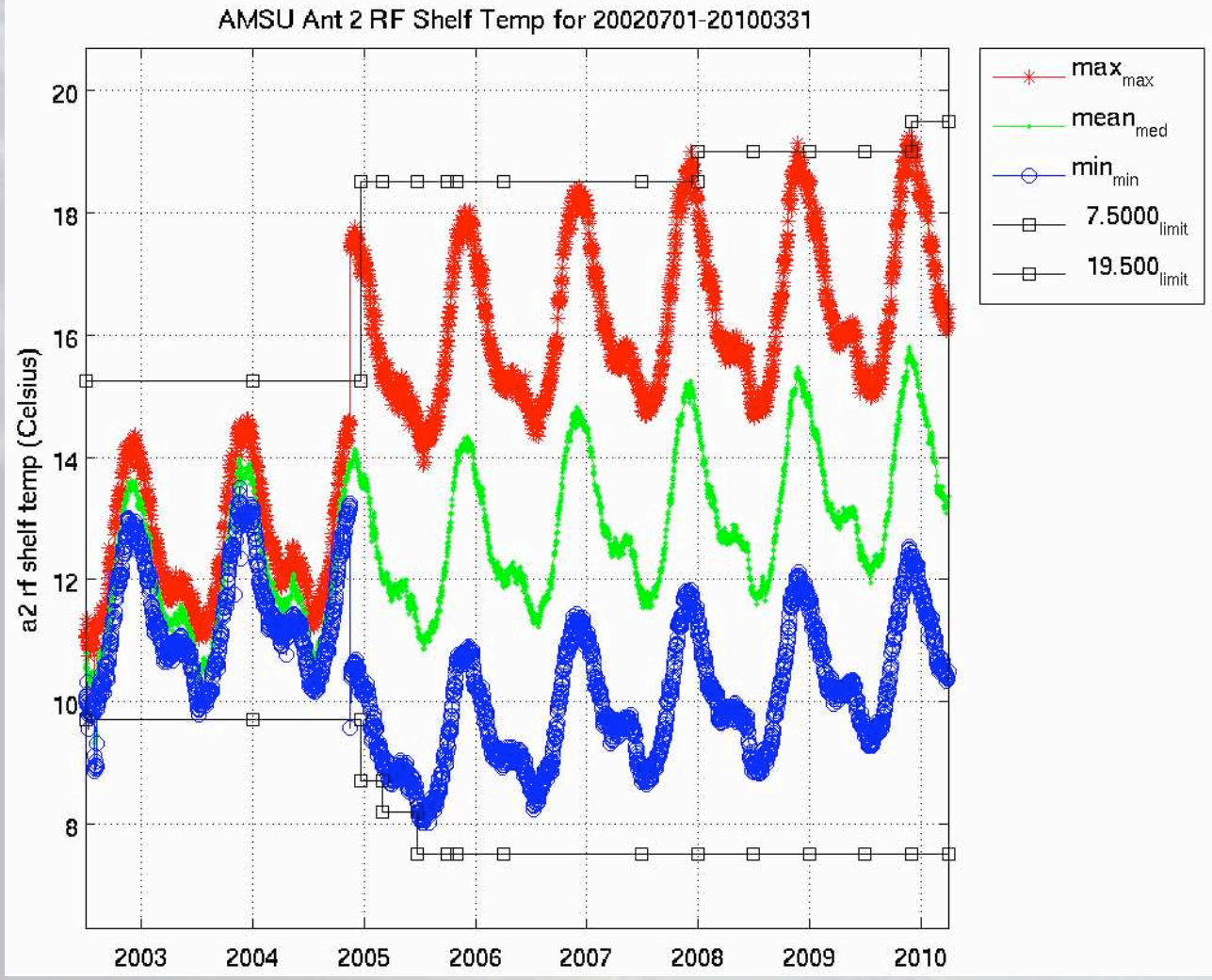
Atmospheric Infrared Sounder

AMSU-A2 RF Shelf Temperature



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AMSU-A1-2 Noisy Bus Current

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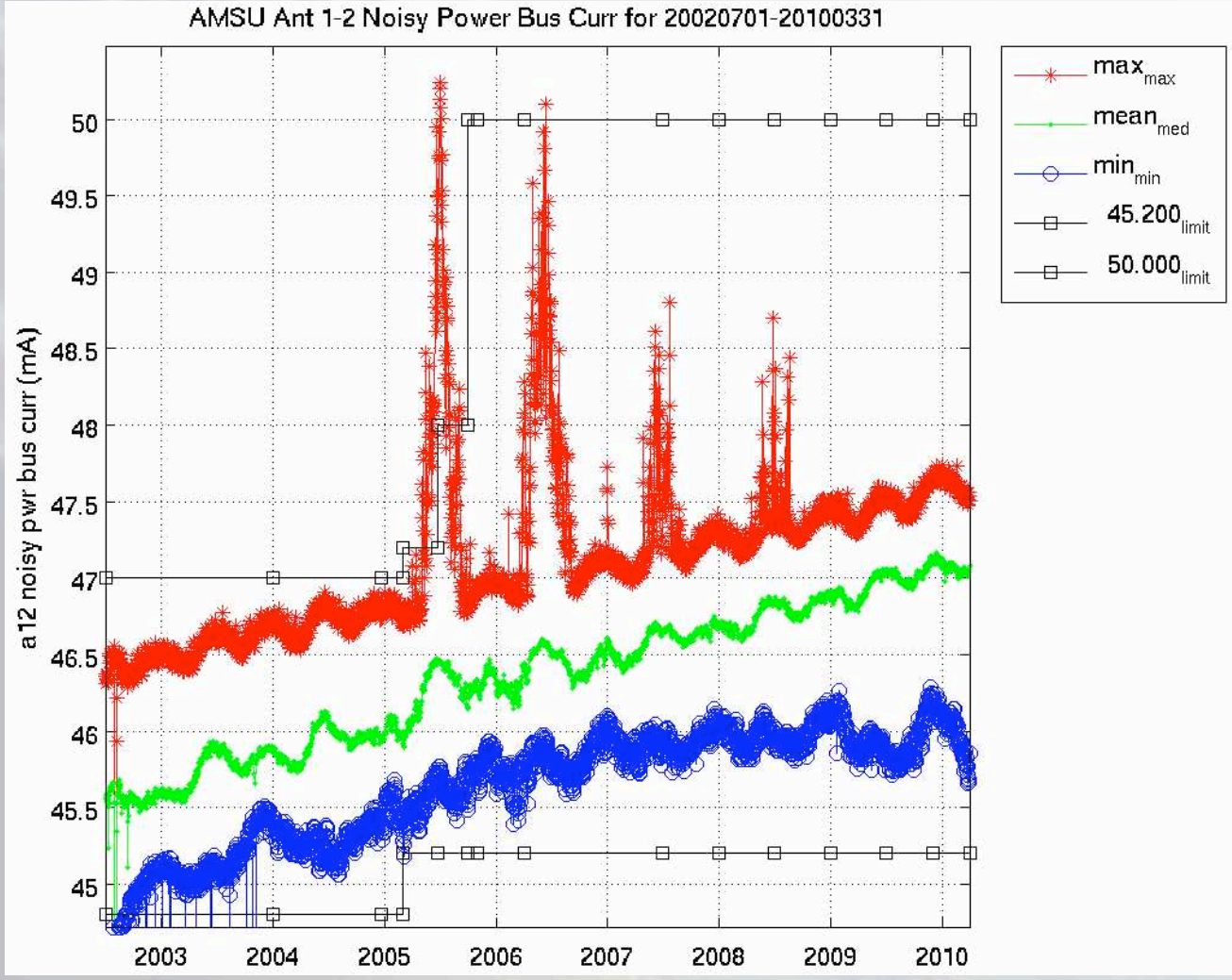

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AMSU-A Channel 5 NEΔT

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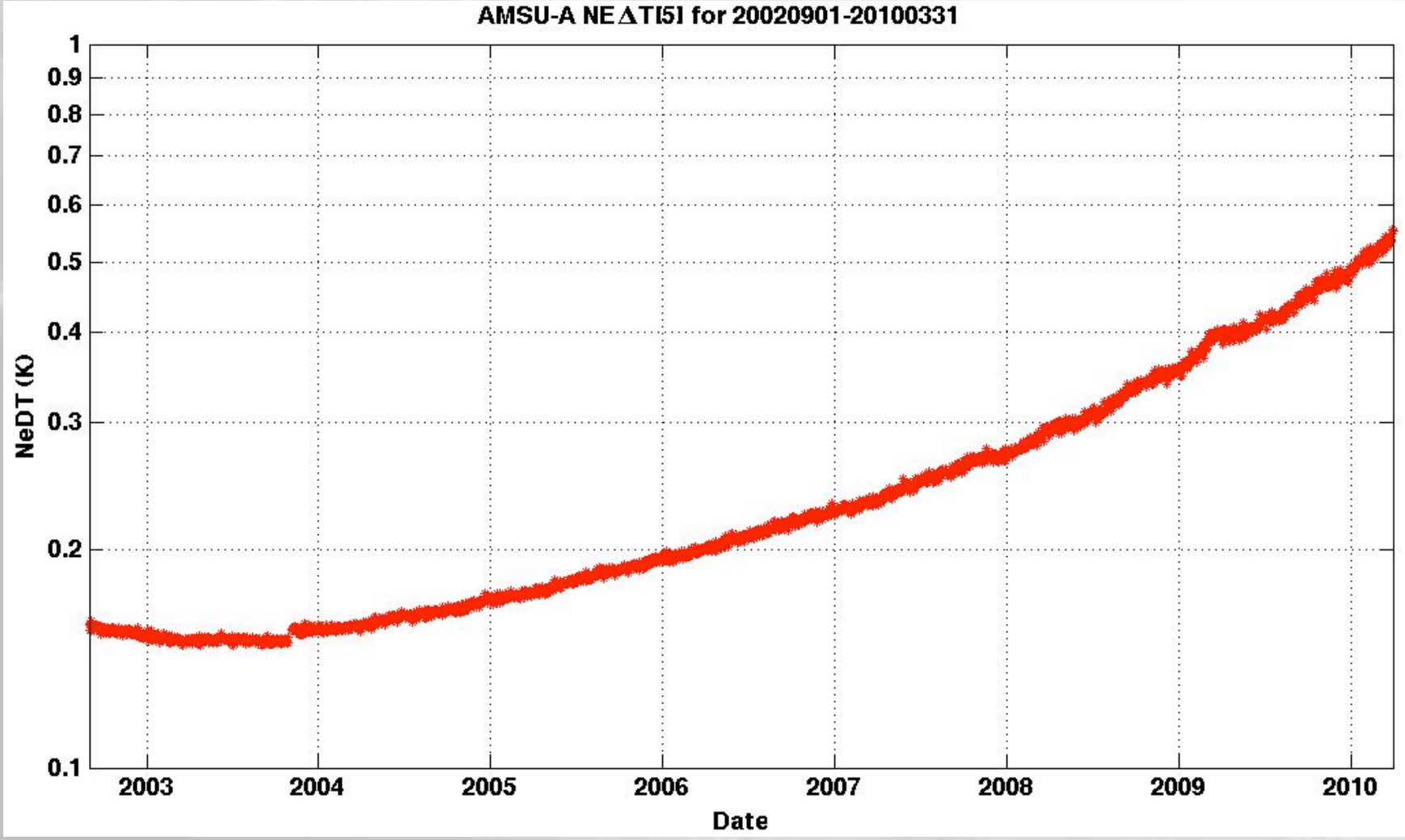

Aqua Status

Aqua Spacecraft Health Status

- **Aqua is in very good health**
- **Several minor anomalies (mostly involving the power system) have occurred over the years**
- **Solar array panel #8 thermistor #6 temperature anomaly began on August 3, 2009**
  - ***Thermistor #6 is no longer providing valid temperature readings of array panel #8***
  - ***The panel itself appears to be operating normally***
  - ***If the other thermistor also fails, there is enough capacity to permit the deactivation of panel #8 without impacting operations***

Aqua Fuel Supply

- **Occasional drag make up burns use only a very small amount of fuel**
- **Most fuel usage takes place in orbital inclination adjustment maneuvers, needed to keep Aqua properly aligned with other A-train instruments and to tightly control our 1:30 pm crossing time**
  - ***A series of three orbital inclination adjustment maneuvers, each involving 9-minute thruster burns, was completed on March 23***
  - ***A recent estimate of future fuel usage indicates that the hydrazine should last at least until 2017, and probably several years more***